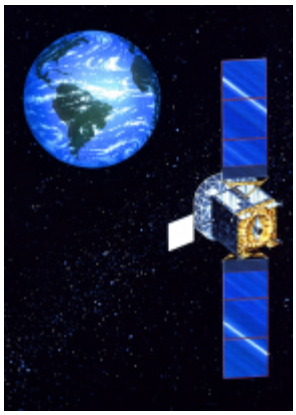
# FACT SHEET

## Navy Communications Satellite Programs

**Office of Congressional and Public Affairs**
**Space & Naval Warfare Systems Command**
**4301 Pacific Highway, San Diego, CA 92110**

# Ultra High Frequency Follow-On (UFO) Program



**HS 601 Satellite**




## *Program History*

**The U.S. Navy has been replacing and upgrading its Ultra-High Frequency (UHF) satellite communications network throughout the 1990s with a constellation of customized Hughes Space & Communications Company (HSC) HS 601 spacecraft known as the UHF Follow-On (UFO) series.**

**The Navy Communications Satellite Program Office (PMW 146), of the Space & Naval Warfare Systems Command in San Diego, has overall responsibility for executing the procurement of the UHF communications satellites for the Defense Department. In July 1988 the Navy awarded a fixed-price competitive contract to HSC to build the UFO satellite constellation and place it in orbit. The UFO contract is an innovative implementation of acquisition reform. The Navy issued contract performance objectives and goals, which allowed the contractor latitude in choosing commercial off-the-shelf components for the satellite and in selecting the commercial launch services for lift to orbit.**

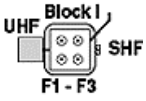
**The initial agreement called for Hughes to build and launch one satellite, with options for nine more, for a total value of $1.9 billion. In March 1996, the Navy ordered a high-power, high-speed Global Broadcast Service (GBS) payload to be incorporated onto the last three satellites. The UFO satellites replace the Hughes-built LEASAT and the TRW built Fleet Satellite (FLTSAT) spacecraft currently supporting the Defense Department's global communications network. This network serves ships at sea, aircraft, and a variety of other U.S. military fixed and mobile terminals used by mobile warriors. The satellites are fully compatible with ground and sea-based terminals already in service. Procurement of an 11$^{th}$ satellite is in progress with a projected launch date of 2003. This satellite will help sustain the UHF constellation into the latter part of the next decade. The Navy has already commenced the planning effort to develop solutions to support the next generation of mobile satellite users.**

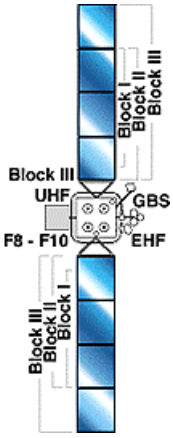
## *Technical Information on the Satellite*

**HSC is manufacturing the UFO satellites in its El Segundo, California factory. The satellites are body-stabilized, three-axis HS 601 models composed of two main modules. The bus module houses the bus electronics, propulsion subsystem, and battery packs. The payload module contains the communications equipment and antennas. Using a building-block approach, Hughes and the Navy are enhancing the constellation capabilities in stages. Satellites F1 through F3 carry UHF and SHF (super-high frequency) payloads. In F4, F5, and F6 there is an additional payload for EHF (extremely high frequency) communications. F7 introduced an enhancement to the EHF package that doubles capacity. The SHF payload is replaced with the GBS package on F8 through F10. The first seven satellites measure more than 60 feet long from the tip of one three-panel solar array wing to the tip of the other. Spacecrafts F8 through F10 each have four solar panels on a side, making them 75 feet long from wing tip to wing tip. These arrays generate a combined 2,370 watts of electrical power on the first three satellites, 2,630 watts for F4 through F7, and 3,800 watts for F8 through F10.**

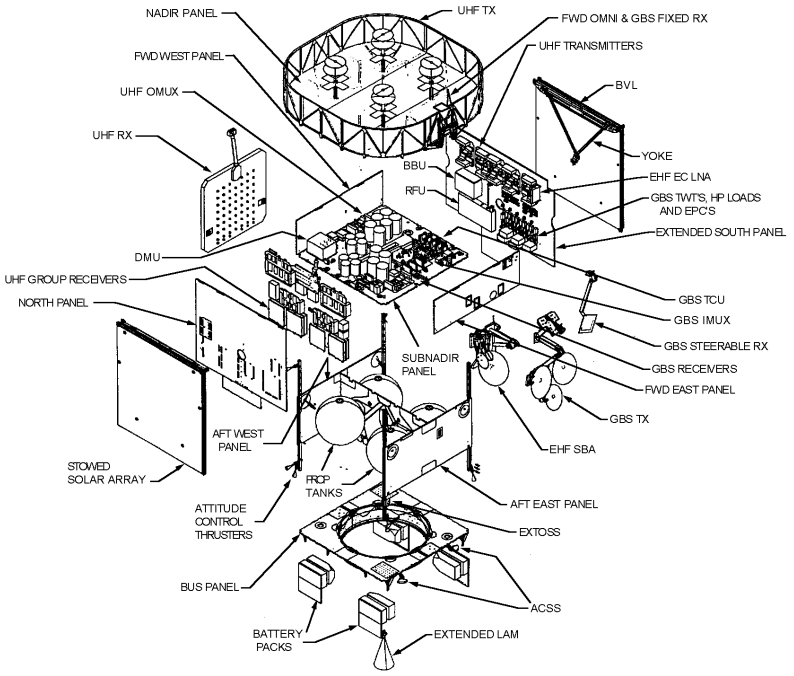
| Spacecraft | Blk | Weight (lbs)* | Power (w)** | L (ft) | W (ft) | Payload |
|---|---|---|---|---|---|---|
| F1 - F3 | I | 2,610 | 2,370 | 60 | 23 | UHF/SHF |
| F4 - F7 | II | 3,050 | 2,630 | 60 | 23 | UHF/SHF/EHF |
| F8 - F10 | III | 3,371 | 3,734 | 75 | 22 | UHF/EHF/GBS |
| F11 | Proposed | | | | | UHF/EHF/ |
| *Beginning of life **End of life | | | | | | |

Height stowed
11Ft
Width stowed
10.5 x 11.1 ft




**F8 Prior to Shipment**




Graphics courtesy of Hughes Space & Communications

**Orbit altitude:** Geosynchronous orbit - 42,164 km /22,766 nm **Launch Site:** Cape Canaveral Air Station, FL.
**Launch Vehicle:** Atlas-Centaur IIA **Mean Mission Duration:** Minimum 10-years

**Space & Naval Warfare Systems Command, Office of Congressional & Public Affairs: Richard Williamson at (619) 524-3432**
**http://www.spawar.navy.mil**

Last Updated: 20 September 1999

## *The Mission of the Satellite*

**The UFO satellites offer increased communications channel capacity over the same frequency spectrum as the current systems. Each spacecraft has 11 solid-state UHF amplifiers and 39 UHF channels with a total 555 kHz bandwidth. These frequencies consist of 21 narrowband channels at 5 kHz each and 17 relay channels at 25 kHz, plus one fleet broadcast channel. In comparison, FLTSAT offers 22 channels. The UFO F1 through F7 spacecraft include a SHF subsystem, which provides redundant command and ranging capabilities when the satellite is on station. In addition, it serves as the secure uplink for Fleet Broadcast Service, which is transmitted to the fleet on UHF.**

**The Navy added an extremely high frequency communications package beginning with the fourth spacecraft. This addition includes 11 EHF channels distributed between an earth coverage beam and a steerable 5-degree spot beam and is compatible with MILSTAR ground terminals. The EHF subsystem provides enhanced anti-jam telemetry, command, broadcast, and fleet interconnectivity communications, using advanced signal processing techniques. The EHF Fleet Broadcast capability supersedes the need for the SHF fleet uplink. Beginning with UFO F7, the EHF package has been enhanced to provide 20 channels through the use of advanced digital integrated circuit technology.**

## *Launch of the Satellites*

**HSC chose Lockheed Martin International Launch Services and the Atlas-Centaur series of rockets to provide launch service from Cape Canaveral, Florida for the UFO satellites. The Atlas I rocket was used for the UHF-only satellites. The Atlas II rocket was used for satellites with the additional EHF payloads and for those with GBS packages. The UFO F2 satellite was the first in the series to go into service, after its successful launch September 3, 1993. The F3 satellite was launched June 24, 1994. Three UFO spacecraft were orbited in 1995: F4 January 28, F5 May 31, and F6 October 22. The F7 satellite was launched July 25, 1996. The final three satellites were modified to carry the GBS package with F8 launched March 16, 1998 and F9 launched October 20, 1998. The present deployment schedule calls for F10 to be launched in late 1999.**

**F8 Launch**

**ATLAS IIA LAUNCH VEHICLE**

**Characteristics**
**Total Liftoff Mass: 187,545-kg (413,470-lb)**
**Total Length: 47.6-m (156.0-ft) with standard length large payload fairing (LPF)**

| | Atlas | Centaur |
|---|---|---|
| **Length:** | **25.0-m (82.0-ft)** | **10.1-m (33-ft)** |
| **Diameter:** | **3.05 m (10-ft)** | **3.05-m (10-ft)** |
| **Propulsion:** | **Two MA-5A** | **Two RL10A-4 (or RL10A-4-1)** |
| **Inert Mass:** | **8,165-kg (18,000-lb)** | **2,000-kg (4,410-lb)** |
| **Flight Expendables:** | **155,495-kg (342,810-lb)** | **16,810-kg (37,060-lb)** |

**For launch, the arrays are folded against the spacecraft bus forming a cube roughly 11 feet per side. Without fuel, the satellites weigh an average of 2600 pounds with the UHF payload, 3000 pounds with the additional EHF payload, and 3400 pounds with the GBS payload.**

## *Operation of the Satellites*

**The 3rd Space Operations Squadron at Schriever Air Force Base, Colorado performs launch, early orbit, and on-orbit operations. The Air Force Satellite Control Network (AFSCN) and the Navy Satellite Control Stations (NSCS) provide telemetry, tracking, and commanding (TT&C) coverage. The satellite is designed to operate for 30 days without ground contact if necessary. Satellite operations have commenced transition to the Naval Space Operations Center at Pt. Mugu, California and all satellites will be under Navy control after the launch of F10.**

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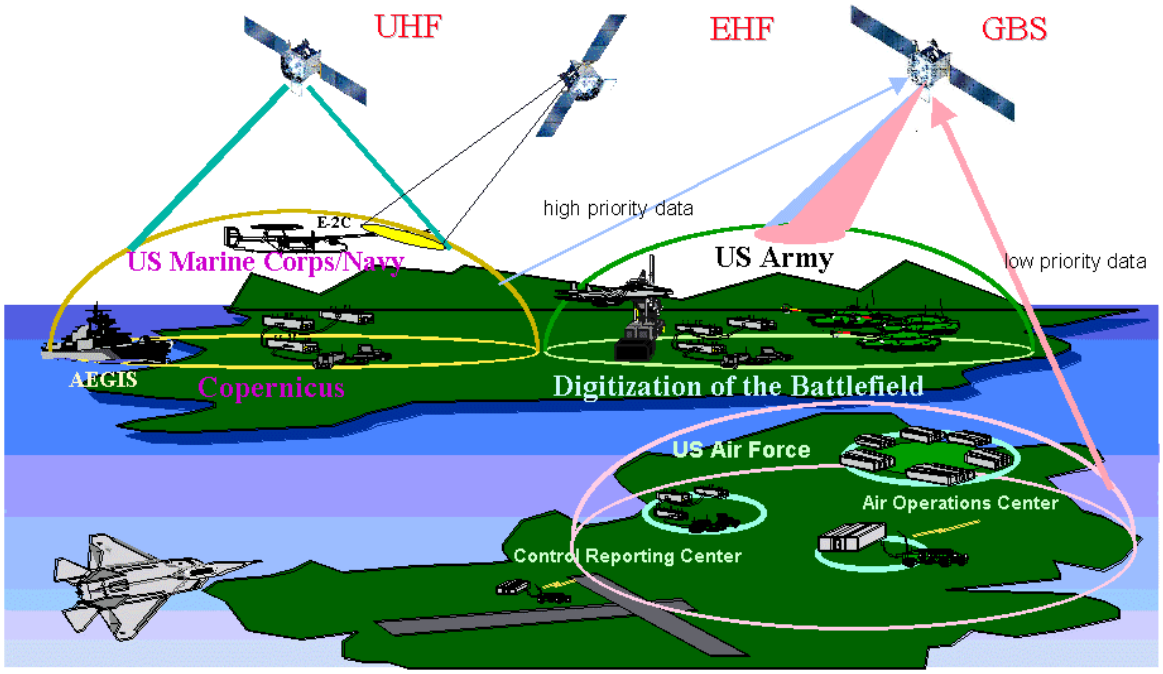
## *Global Broadcast Service (GBS)*

**The GBS payload replaces the SHF payload on spacecraft F8, F9, and F10. This new package includes four 130-watt, 24 megabits-per-second (Mbps) military Ka-band (30/20 GHz) transponders with three steerable downlink spot beam antennas (two at 500 nmi and one at 2000 nmi) as well as one steerable and one fixed uplink antenna. This modification results in a 96 Mbps capability per satellite. Three spacecraft give the DOD near-global coverage. The systems will transmit to small, mobile, tactical terminals.**




**This GBS package revolutionizes communications for the full range of the Defense Department's high-capacity requirements, from intelligence dissemination to quality-of-life programming. The payloads were successfully integrated under a tight production schedule meeting the F8 launch deadline. F10 completes the full, three satellite operational capability.**

## *Related Information and Web Sites*

**Navy Communications Satellite Program Office (PMW 146): http://www.pmw146.navy.mil/**

**Hughes Space & Communications Company: http://www.hughespace.com/home.html**

**Lockheed Martin Astronautics: http://www.ast.lmco.com/**

**International Launch Services: http://www.lmco.com/ILS/index.htm**

**U.S. Air Force Space Command's 45th Space Wing Office of Public Affairs: http://www.pafb.af.mil/**

**Space &Naval Warfare Systems Command: http://www.spawar.navy.mil/**

**Naval Space Command: http://www.navspace.navy.mil/**

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